NOTES ON SOME FUNGAL INFECTIONS IN WEST AFRICA

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Fungal infections are abundant in West Africa, but hitherto comparatively little attention has been devoted to them. Brief notes are given in this paper on a few cases which have recently come under our notice at Accra in the Gold Coast.

The part played by the fungi of the Genus *Monilia* in the diseases from which the patients were suffering is obscure. Such fungi are undoubtedly abundant in the tropics, and contamination with them must be guarded against; it is also true that they are not infrequently present in small numbers in the faeces of apparently healthy individuals. Their occurrence in great quantities is, however, a different matter. No evidence is brought forward in support of the view that the species of *Monilia* described in this paper were the sole cause of the dysentery and diarrhoea with which they were associated, indeed there was evidence that the cases referred to in Section II were due primarily to a dietetic deficiency, but it is maintained that they were the cause of some of the symptoms. For this reason, and because the intestinal disturbances which permit of their multiplication may be of profound significance, their recognition and investigation is of importance.

I. A FUNGUS OF THE GENUS *MONILIA* RECOVERED FROM A PATIENT SUFFERING FROM DYSENTERIC DIARRHOEA

Towards the end of the year 1920 there occurred at Accra a considerable number of cases of dysenteric diarrhoea, the cause of which was obscure. From one such case, a European man about forty years of age, the *Monilia* was isolated, of which the following is a short description. The sample of faeces from which the fungus was recovered contained much blood and mucous, but no amoebae and no other parasite to which a pathogenic rôle could be assigned; it contained, however, a considerable number of yeast-like cells. From the same case, a week later, Dr. J. F. Corson isolated a bacillus which gave the reactions of Morgan's bacillus.

Several species of the Genus *Monilia* have been isolated from human faeces in various parts of the world, but especially in the tropics, and some of them have been regarded as being the cause, either directly or indirectly, of intestinal disease. Similar fungi are frequently found in small numbers in specimens of faeces in West Africa, and in diarrhoeic stools are sometimes very numerous. With regard to the species isolated from this case of dysenteric diarrhoea at Accra it is not possible to say if it was pathogenic, but it may be noted that it closely resembled *M. tropicalis*, one of the species which has been found to be present in sprue (Castellani, 1920).

The Organism. The *Monilia* found in this case was isolated in a culture of the faeces on neutral-red lactose bile-salt agar. It was Gram-positive and not acid fast. It grew well on most solid media, and on glucose agar produced within twenty-four hours an abundant creamy-white growth. Under anaerobic conditions growth was less abundant and less rapid. It grew freely both at 37° C. and at the temperature of the laboratory (about 26° C.). Gelatin and blood serum were neither liquefied nor stained. In broth and peptone water a whitish deposit was thrown down, whilst the media themselves remained clear; in both a surface pellicle was formed. It produced an abundant white growth on potato, which later developed a white efflorescence; the medium was not stained. On solid media the growth was mainly composed of yeast-like cells, but a few branched septate hyphae were usually present; in fluid media the hyphae sometimes predominated.

Its qualitative bio-chemical reactions may be tabulated as follows, the symbols representing:—A = acidity; G = gas; s = slight; O = neither acid nor gas.

Arabinose	O	Inulin	O
Rhamnose (isodulcite) ...	O	Amygdalin	O
Galactose	AGs	Helicin	O
Glucose	AG	Phlorrhizin	O
Laevulose	AG	Salicin	O
Mannose...	O	Glycerol	O
Lactose	O	Erythrol	O
Maltose	AG	Adonitol	O
Saccharose	AGs	Dulcitol	O
Raffinose...	O	Inosite	O
Amylum	O	Mannitol	O
Dextrin	O	Sorbitol	O
Glycogen	O		

If the cultures were kept, the acidity produced in the five sugary media indicated tended to be superceded by alkalinity; this change began to occur early, usually in less than a week. No change was produced in Litmus milk at first, but after a week or ten days a slight alkalinity was sometimes noticed; no clot was formed, and the medium was neither decolourized nor peptonized. Indol was not produced in peptone water.

As gas was produced in Glucose, Laevulose, Maltose, Galactose, and Saccharose the organism comes into the fifth group of species of *Monilia*, the *Tropicalis* group, according to the classification of Castellani and Chalmers (1919). The more important bio-chemical reactions of the species in this group are shown in Table I. It will be noted that the species here described differs in its reactions in Mannitol and Dextrin from *M. enterica*, *M. insolita*, *M. paratropicalis*, and *M. pulmonalis*. From *M. faecalis* it may be distinguished by the fact that it does not decolourize Litmus milk, and does not stain blood serum brown; and from *M. metatropicalis* by the fact that it does not clot milk. As regards *M. nivea*, the fact that neither acid nor gas is produced in Raffinose is a point of distinction, and it may be noted also that our species produces only a slight amount of gas in Galactose and forms a pellicle on the surface of broth, reactions which are not found in the case of *M. nivea*. Our organism closely resembles *M. tropicalis*, the greatest divergence being in the reaction in milk. It is said that by *M. tropicalis* 'Litmus milk is generally rendered acid but is not

clotted,' a statement which would seem to imply that the production of acid is not constant nor characteristic. If this is so, the two species appear to be identical, excepting that in the case of our organism a pellicle is formed in broth.

TABLE I.

Species of the Genus *Monilia* belonging to the *Tropicalis* group.

Species of *Monilia*	Litmus milk	Glucose	Laevulose	Maltose	Galactose	Saccharose	Mannitol	Dextrin	Raffinose	Arabinose	Broth
M. enterica	O/Alk	AG	AG	AG	AG	AG	As	As	O	O	C
M. faecalis	A/DPs	AG	AG	AG	AGs	AGs	O	O	O	O	C
M. insolita	As/Alk	AG	AG	AG	AG	AG	As	O	O	O	C
M. metatropicalis	AC	AG	AG	AG	AG	AG	O	O	O	O	C
M. nivea	O/Alk	AG	AG	AG	AG	AGs	O	O	AG	O	C
M. paratropicalis	As/Alk	AG	AG	AG	AG	AG	O	Avs	O	O	CTP
M. pulmonalis	O/AlkD	AG	AG	AG	AGs	AG	Avs	O	A	AGs	CTP
M. tropicalis	A	AG	AG	AG	AGs	AGs	O	O	O	O	C
Accra case : sputum and pleural cavity (*M. accraensis*)	O/Alk	AG	AGs	AGs	AG	AG	O	O	O	O	C
Accra case : dysenteric faeces ...	O/Alk	AG	AG	AG	AGs	AGs	O	O	O	O	CTP

A = acidity ; Alk = alkalinity ; C = clot (milk), clear (broth) ; CTP = clear, then pellicle ; D = decolourized ; G = gas ; O = neither acid nor gas ; P = peptonized ; s = slight ; vs = very slight.

Finally it may be noted that this organism closely resembles a species of *Monilia* (*M. accraensis*) recently found by us in the sputum and pleural cavity of a patient suffering from tuberculosis at Accra (1921). The chief points of distinction are that the intestinal species produces only a slight amount of gas in Galactose and Saccharose, and forms a pellicle on broth; whereas the pulmonary species produces much gas in Galactose and Saccharose but only little in Laevulose and Maltose, and does not form a pellicle on broth.

SUMMARY

From the faeces of a European with dysenteric symptoms a fungus of the Genus *Monilia* was isolated. This organism belongs

to the *Tropicalis* group, and appears to resemble most closely *M. tropicalis* (Castellani, 1909).

REFERENCES

Castellani, A. (1920). Milroy Lectures. *Journ. Trop. Med. and Hyg.*, XXIII, p. 120.

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II. TWO FUNGI OF THE GENUS *MONILIA* RECOVERED FROM AFRICANS SUFFERING FROM A PECULIAR FORM OF DIARRHOEA

There occurs among the natives at Accra a well defined form of persistent diarrhoea which has been considered by some of the medical practitioners in the Gold Coast to be akin to sprue. The stools are bulky, frothy, and generally canary-yellow coloured; the tongue is red, fissured, and eroded; and the patients are wasted—a condition which is often masked by oedemas of the limbs and by ascites. The faeces in such cases usually teem with yeast-like cells which on cultivation are found to be stages of fungi of the Genus *Monilia*. The following are short descriptions of the organisms isolated from two such cases.

First Case.

The patient, a native man about twenty-seven years of age, was suffering from an obstinate diarrhoea, and was weak and wasted. His tongue was red, irregularly fissured, indented by the teeth, and partially eroded; the throat also was red. The faeces were canary-yellow coloured and frothy; yeast-like cells were extremely abundant in them, and *Entamoeba coli* and *Blastocystis enterocola* were also present.

The Organism. The *Monilia* in this case was isolated from a culture of the faeces on neutral-red lactose bile-salt agar. It was Gram-positive and not acid fast. It grew well on most solid media, and on Glucose agar produced within twenty-four hours an abundant white growth, very fluid in consistence, and with a dull pellicle-like surface. The yeast-like cells, which composed the greater part of the growth, were oval and somewhat elongated; the average

measurements of ten cells were, length 4·5μ, breadth 1·6μ. Under anaerobic conditions growth was less abundant and less rapid. Gelatin and blood serum were neither liquefied nor stained. In broth and peptone water a whitish deposit was thrown down, and the medium remained clear; in broth a surface pellicle was formed. On potato a dull white growth was developed which later showed a white efflorescence; the medium was not stained. On solid media the growth was mainly composed of yeast-like cells, but a few branched, septate hyphae were also present; in fluid media hyphae sometimes predominated.

The qualitative bio-chemical reactions of this *Monilia* may be tabulated as follows:—

Arabinose	O	Inulin	O
Rhamnose (isodulcite) ...	O	Amygdalin	O
Galactose	O	Helicin	As
Glucose	AG	Phlorrhizin	O
Laevulose	AG	Salicin	O
Mannose...	O	Glycerol	O
Lactose	O	Erythrol	O
Maltose	AGs	Adonitol	O
Saccharose	AG	Dulcitol	O
Raffinose...	AGs	Inosite	O
Amylum	O	Mannitol	O
Dextrin	AG	Sorbitol	O
Glycogen	O		

The symbols representing: A = acidity; G = gas; s = slight; O = neither acid nor gas.

In the media in which acidity was produced the reaction tended after a few days to be succeeded by alkalinity. No change was produced in Litmus milk. Indol was not produced in peptone water.

As gas was produced in Dextrin as well as in other media the organism comes into the ninth group of species of *Monilia*, the *Pseudolondinensis* group, according to the classification of Castellani and Chalmers (1919). Two species belong to this group, namely, *M. pseudolondinensis*, Cast., and *M. pseudolondinoides*, Cast., which appear to differ only in their actions on Litmus milk. The more important bio-chemical reactions of these species and of the organism just described are given in Table II; it will be noted that

the latter species differs from the other two in its actions on Galactose, Saccharose, and Raffinose. These differences are important, and since the classification of these fungi is at present

TABLE II.

Species of the Genus *Monilia* belonging to the *Pseudolondinensis* group.

Species of *Monilia*	Litmus milk	Glucose	Laevulose	Maltose	Galactose	Saccharose	Raffinose	Dextrin
M. pseudolondinensis, Cast.	O	AG	AG	AG	AG	O	O	AG
M. pseudolondinoides, Cast.	AC	AG	AG	AG	AG	O	O	AG
M. africana, sp.n.	O	AG	AG	AGs	O	AG	AGs	AG

A = acid; G = gas; s = slight; O = neither acid nor gas; C = clot.

based on such bio-chemical reactions, the organism described here must be regarded as a new species. For it, therefore, the name *Monilia africana* is proposed.

SECOND CASE.

The patient, an adult native man, a Moshi, was suffering from persistent diarrhoea accompanied by ascites and oedema of the face, especially the left parotid area, the lumbar region, and the penis. There was no oedema of the legs. The faeces were semi-fluid, pale canary-yellow coloured, and frothy; they contained very numerous yeast-like cells.

The Organism. The *Monilia* in this case was isolated from a culture of the faeces on neutral-red lactose bile-salt agar. The colonies of yeast-like cells were rather slow in appearing, being detected first after forty-eight hours' incubation. It was Gram-positive and not acid fast. It grew well on most solid media, spreading as a thin film, and on Glucose agar produced within twenty-four hours an abundant white growth. The yeast-like cells which composed the greater part of this growth were, as in the previous case, somewhat elongated. Under anaerobic conditions growth was slower. Gelatin and blood serum were neither liquefied nor stained; the growth on gelatin was slow. In broth and peptone water a whitish deposit was thrown down, the medium remained

clear, and no pellicle was formed. On potato an abundant whitish growth was produced, and the medium was not stained. On solid media the growth was composed mainly of yeast-like cells, but a few branched, septate hyphae were also present; in fluid media hyphae sometimes predominated.

The qualitative bio-chemical reactions of this *Monilia* may be tabulated as follows:—

Arabinose	O	Inulin	O
Rhamnose (isodulcite) ...	O	Amygdalin	O
Galactose	A	Helicin	As
Glucose	AGs	Phlorrhizin	O
Laevulose	AGs	Salicin	As
Mannose...	O	Glycerol	O
Lactose	O	Erythrol	O
Maltose	A	Adonitol	O
Saccharose	O	Dulcitol	O
Raffinose...	O	Inosite	O
Amylum	O	Mannitol	O
Dextrin	O	Sorbitol	O
Glycogen	O		

The symbols representing: A = acidity; G = gas; s = slight; O = neither acid nor gas.

In the media in which acidity was produced the reaction tended after a few days to be succeeded by alkalinity. No change was produced in Litmus milk. Indol was not produced in peptone water.

As gas was produced in Glucose and Laevulose only, the organism comes into the second group of species of *Monilia*, the *Krusei* group, according to the classification of Castellani and Chalmers (1919). Two species are included in this group, namely, *M. krusei*, Cast., and *M. parakrusei*, Cast., which appear to differ only in their actions on Litmus milk. The more important bio-chemical reactions of these species and of the organism just described are given in Table III; it will be noted that the latter species differs from the other two in its actions on Maltose and Galactose besides in several minor points. These differences, according to the system of classification at present in vogue, are sufficient to justify the erection of a new species, and, therefore, although the number of species of the Genus *Monilia* is already embarrassingly large, we propose for this organism the name *Monilia enterocola*.

TABLE III.

Species of the Genus *Monilia* belonging to the *Krusei* group.

Species of *Monilia*	Litmus milk	Glucose	Laevulose	Maltose	Galactose	Saccharose
M. krusei, Cast.	O	AG	AG	O	O	O
M. parakrusei, Cast.	AC	AG	AG	O	O	O
M. enterocola, sp.n.	O	AGvs	AGs	A	A	O

A = acid; G = gas; s = slight; vs = very slight; O = neither acid nor gas; C = clot.

SUMMARY

From the faeces of two Africans suffering from a peculiar form of diarrhoea two fungi of the Genus *Monilia* were isolated, both of which appear to be hitherto undescribed species. The one belongs to the *Pseudolondinensis* group, the other to the *Krusei* group of Castellani and Chalmers. The names *Monilia africana* and *Monilia enterocola*, respectively, are proposed for these organisms.

III. A NOTE ON A CASE OF OTOMYCOSIS

Otomycosis is said to be not uncommon in the tropics. It may be caused by a considerable number of different fungi, and according to Castellani and Chalmers (1919), 'if they grow superficially, they cause no symptoms; but if they penetrate into the mucous membrane, they give rise to itching, and sometimes to pain.'

The patient whose case is the subject of this note was a European lady who consulted Dr. C. V. Le Fanu at Accra in the Gold Coast Colony, West Africa, on account of pain and irritation in the ear. The symptoms had existed for at least a month, but although they caused no little discomfort, there was no deafness. On examination Dr. Le Fanu found that the external auditory meatus was unusually narrow, but widened out at its inner end so as to form a small chamber immediately external to the drum of the ear. From a patch on the vault of this chamber, close to the drum of the ear, the fungus

was growing and hanging down like a veil. It may be said at once that the condition was rapidly relieved, and apparently cured, by an application containing as its principal constituent salicylic acid.

The fungus, which grew readily on Sabouraud's maltose agar and was easily obtained in pure culture on this medium, appeared to belong to the Genus *Sterigmatocystis*, Cramer 1859. Two species of this genus have been found in cases of otomycosis, namely, *S. antacustica* and *S. nidulans*, but the characters of both, as given in the descriptions to which I have access, differ slightly from those of the fungus isolated at Accra. The exact determination of the species of such a fungus is a matter for a mycologist. I shall, therefore, restrict myself to recording certain characters which may enable those who have made a special study of these fungi to place it more exactly.

Cultures. On Sabouraud's maltose agar the growth of the fungus was rapid and spreading; at first yellowish-white and felt-like, then slightly fluffy with the development of upstanding conidiophores, then speckled with dark brown points when the conidiophores began to develop their spores, and finally dark brown or almost black all over, resembling a mass of soot. On Glucose agar the initial growth at a temperature of 28° C. was almost white, with a somewhat puckered and wrinkled surface, but within twenty-four hours became yellowish, and began to show upstanding, white conidiophores. On the following day the whole surface of the medium was covered by a yellow, wrinkled, felt-like growth, on which were very many conidiophores, some already dark brown in colour. On the third day the whole surface of the medium looked as if it had been thickly dusted with soot. Growth, therefore, was rapid and abundant at 28° C., the temperature of the laboratory; it was, however, even more rapid at 37° C. In peptone water the fungus grew mainly on the surface, but detached fragments in the fluid produced delicate networks of hyphae which sometimes resembled puff-balls. Dark spores were formed on the conidiophores at the surface. In glucose peptone water acid was produced, but no gas. On blood serum growth was rather slow, the colonies were white, and the black spore-bearing conidiophores did not develop for a long time and were relatively scanty. Eventually the medium was liquefied. In a

gelatin stab culture there was no deep growth, and no liquefaction. A white surface growth developed with dark sooty grains, and later, just below the surface, there formed compact cerebriform whitish masses of the fungus. On potato growth was rapid and abundant; at first a yellowish felt-work, finally a sooty mass. In Litmus milk acid and clot were produced. The growth was mainly at the surface, was yellowish, and developed the usual dark brown sooty appearance.

Mycology. All the growths showed septate, branched hyphae of varying diameter. The hyphae appeared colourless when seen with a microscope. The lengths of the interspaces were very variable. In fluid media, such as glucose peptone water, chlamydospores were numerous in the surface felt-like growth. The conidiophores were erect. In cultures they were raised about 1 mm. above the level of the medium, but in the ear of the patient they appeared to be considerably longer. They were white on first appearance, but darkened later. The diameter of the stem was variable, but averaged about 14μ. The head was almost spherical, slightly broader than long, its diameters averaging 40μ and 37μ respectively; it was covered almost completely by sterigmata, only a very narrow zone at the proximal end, at the insertion of the stalk, being free from them. Both primary and secondary sterigmata were present; the primary sterigmata were about 12μ long (average of ten), the secondary about 8μ long (average of ten). There were usually four secondary sterigmata on each primary sterigma. The spores were dark brown in colour, and spherical in shape; diameter 4μ to 5·2μ, average 4·5μ.

Animal inoculations. Two wild *Mus rattus* were given intraperitoneal inoculations of an emulsion of a small fragment of the original culture in normal saline. No ill-effects were observed to follow. A little of the same culture was applied to the external auditory meatus of a pouched rat (*Cricetomys gambianus*), a sheep, and a small monkey (*Cercopithecus patas*) after scarification, but no otomycosis was produced.

REFERENCE

Castellani, A., and Chalmers, A. J. (1919). *Manual of Tropical Medicine*, Third Edition, p. 2012. London: Bailliere, Tindall and Cox.

IV. TONSILLAR NOCARDIOMYCOSIS

One case of tonsillar nocardiomycosis has been met with at Accra. The patient, a European man, about thirty-two years of age, showed a number of small white concretions in crypts of both tonsils. The throat was not inflamed, and there was neither pain nor discomfort; but the presence of the concretions had been detected by the patient at least a month previously, and he was worried about them as they did not show any signs of disappearing.

Scrapings from one of the white patches consisted mainly of fungal hyphae in short lengths. They were about 1 μ in diameter, branched, and either Gram-positive or composed of Gram-positive coccoid bodies and rods connected together by Gram-negative strands.

Inoculations made on agar and glucose agar were unsuccessful. Further particulars with regard to the fungus cannot, therefore, be given.

This condition is referred to by Castellani and Chalmers (1919) in their *Manual of Tropical Medicine*. The above case is recorded here merely to draw attention to the fact that it occurs in West Africa.

REFERENCE

Castellani, A., and Chalmers, A. J. (1919). *Manual of Tropical Medicine*, Third Edition, pp. 1747-8. London: Bailliere, Tindall and Cox.